

Species: *Aster alpinus* L. var. *vierhapperi* (Onno) Cronquist

Synonyms – *Aster alpinus* L. subsp. *vierhapperi* Onno, *Diplactis alpina* (L.) Semple p.p.

Common names – Vierhapper's aster, alpine aster

Status: Table 1 summarizes the current status of this plant by various ranking entities and defines the meaning of the status.

Table 1. Current status of <i>Aster alpinus</i> var. <i>vierhapperi</i>		
Entity	Status	Status Definition
NatureServe	G5T5	G5—Globally secure – Common, widespread, and abundant. Perpetually secure under present conditions. Typically with considerably more than 100 occurrences and more than 10,000 individuals. T5 – Taxon secure
Colorado Natural Heritage Program (CNHP)	S1	S1 – State critically imperiled - Critically imperiled because of extreme rarity or because of some factor(s) making it especially vulnerable to extirpation or extinction. Typically 5 or fewer occurrences or less than 1000 remaining individuals.
USDA Forest Service	None	
USDI Fish and Wildlife Service	Not listed	Not federally recognized under the Endangered Species Act (ESA) as endangered, threatened, proposed, or candidate species.

The 2012 U.S. Forest Service Planning Rule defines Species of Conservation Concern (SCC) as “a species, other than federally recognized threatened, endangered, proposed, or candidate species, that is known to occur in the plan area and for which the regional forester has determined that the best available scientific information indicates substantial concern about the species' capability to persist over the long-term in the plan area” (36 CFR 219.9). This overview was developed to summarize information relating to this species' consideration to be listed as a SCC on the Rio Grande National Forest, and to aid in the development of plan components and monitoring objectives.

Distribution, abundance, and population trend on the planning unit:

According to the USDA PLANTS database *Aster alpinus* var. *vierhapperi* is known from Canada, Alaska, and Colorado (USDA NRCS 2015). NatureServe reports that it is also known from Wyoming (NatureServe 2015), and The Flora of North America (FNA 1993) indicates that it is also found in Idaho. Moore and Friedley (2006) note that the variety is represented by ten disjunct occurrences, nine of which

are on National Forest System lands. Six of those occurrences are in Region 2 (Colorado and Wyoming); the other four are in Region 4 (Idaho).

There is one CNHP element occurrence record of *Aster alpinus* var. *vierhapperi* on the edge of the planning area (in the San Juan Mountains). The occurrence was reported in 1968; CNHP reports that it has not been revisited and there is no data pertaining to the size or condition of the occurrence (CNHP 2015). There is some uncertainty about the location of the 1968 location, but the collection notes indicate that it was collected on Rat Creek which is on the Rio Grande NF side of the Continental Divide.

The taxon appears to be sufficiently abundant and secure to be viable in its primary range (as indicated by the G5T5 status); it appears to be much less secure in the disjunct occurrences in Colorado, Wyoming and Idaho (as indicated by the S1 status). Moore and Friedley (2006) state the lack of information prevents any conclusions about determining habitat quality, estimating population trends, and pinpointing risks associated with reproductive mechanisms for this variety within Region 2 or throughout its range.

USFS Corporate Database Habitat Type Associated with the Species:

The historical occurrence on the RGNF is located in the Alpine Sedges and Forbs on Alpine Summits Land Type Association (RGNF GIS data).

Apparently, within its primary range this variety shows a broad range of habitat types. This does not appear to be the case in the southern end of its range in the United States. All but one of the known southern populations are located at high elevations, typically occupying the alpine tundra on the slopes and saddles of the high mountains. Many occurrences are located along the continental divide. One occurrence was documented in an aspen forest in the montane zone. In Region 2, *Aster alpinus* var. *vierhapperi* occurs within the Southern Rocky Mountain Steppe-Open Woodland-Coniferous Forest-Alpine Meadow Province. It occurs or potentially occurs in several sections within this province, including the South-Central Highlands, Northern-Central Highlands-Rocky Mountain, and the Northern Parks and Ranges. This taxon also has documented occurrences or could occur in several sections of the Middle Rocky Mountain Steppe-Coniferous Forest-Alpine Meadow Province, generally located within Region 4 and Region 1 (Moore and Friedley 2006).

CNHP Ecological System of the Southern Rocky Mountains Ecoregion:

Moore and Friedley (2006) state that there are not enough available habitat data for the taxon to definitively place it in one of the four alpine communities described by CNHP: Alpine Substrate/Ice Field, Alpine Tundra Dry Meadow, Alpine Tundra Fellfield, and Alpine Dwarf Shrubland. The mosaic nature of the alpine ecosystem, in general, is such that all four of these alpine communities can occur within a relatively small area.

Brief description of natural history and key ecological functions:

Aster alpinus var. *vierhapperi* is a rhizomatous, caespitose, perennial herb, 4 to 12 inches tall. The stems are shortly gray-pubescent, with woolly villous to densely woolly villous pubescence under the heads. The heads are solitary, large, and rather showy. The disks are approximately 2 cm wide or more. Ray flowers are generally white (sometimes violet or lavender), reflexed, and shrunken, but they are persistent after flowering. Disk flowers are yellow. Moore and Friedley (2006) report that it is apparently easily identified

in the field due to its dwarf stature, large solitary heads, and appressed-strigose pubescence on the involucre. The known occurrences in Region 2 have been found at elevations ranging from 8,400 to 12,000 feet.

There have been no studies on the life history, demographic rates, reproductive rate, or longevity of *Aster alpinus* var. *vierhapperi*.

The morphology of small tundra plants such as *Aster alpinus* var. *vierhapperi* helps them to increase survival in harsh alpine conditions such as cold temperatures, desiccating winds, intense solar radiation, and low moisture. When growing in exposed areas, these species must overcome environmental obstacles such as erosion/deposition, high water runoff, and intense solar radiation and wind. The low growth and small size presumably keeps individuals out of harsh winds, reduces plant tissue growth needs, creates less distance to transport water, allows interception of both solar radiation and ground-reflected radiation, and affords protection to the inner parts of the plant.

The life history of *Aster alpinus* var. *vierhapperi* remains uninvestigated at this time. Observations by field botanists note populations were flowering and fruiting, indicating the occurrences were reproducing. However, no observations were recorded concerning the presence of seedlings (Moore and Friedley 2006).

Information concerning the demographic spatial characteristics for this taxon is limited. Only one of all known occurrences in Region 2 has an estimated abundance, and no genetic data exist. Population growth or establishment could be limited by competition with other species (e.g., invasive species), inadequate genetic variability for long-term persistence, ineffective pollination, or reduced habitat availability, as a result of human-related changes or environmental fluctuations. The rate at which colonization and establishment of new populations occurs is unknown and it is unclear what type, size, intensity, or frequency of disturbance regime is important.

Overview of ecological conditions for recovery, conservation, and viability:

There is a relatively large amount of alpine environment with potential habitat present in both the Sangre de Cristo Mountains and the San Juan Mountains within the RGNF. It is generally assumed that there are few threats to this species because of its largely inaccessible habitat. Alpine environments are generally intact with only minor and localized impacts. However, the limited abundance and disjunct distribution of *Aster alpinus* var. *vierhapperi* on National Forest System lands within Region 2 generates a concern for the viability of this taxon. Region 2 occurrences of this taxon are remote and small, or of unknown size, the resulting lack of information makes it difficult to identify threats (Moore and Friedley 2006).

Occurrences of *Aster alpinus* var. *vierhapperi* may be at risk from environmental or demographic stochasticity due to the small neighborhood size of populations. Threats to reproductive processes (e.g., inadequate pollinator activity, possible outbreeding depression through a hybridization event, lack of safe sites for germination or seedling establishment) as well as unknown barriers to gene flow may pose possible risks to this taxon. Other threats that may affect *A. alpinus* var. *vierhapperi* include environmental factors, such as global warming, nitrogen deposition, or silver iodide pollution (Moore and Friedley 2006).

Although there are no reports of non-native invasive plant species specifically affecting *Aster alpinus* var. *vierhapperi*, invasive species are always a threat to rare plants. The potential for infestation in alpine habitat is reduced, however the potential ecosystem impacts from invasive species, such as their effects on pollinators, must also be considered.

Global warming has been identified as a potential threat to alpine communities and could severely affect plants trapped on high mountain islands. Both lower elevation and alpine snow covers are very sensitive to changes in climate. Theoretically, snow cover could be reduced in extent, duration, and depth. Global warming could result in an alteration of timberlines encroaching on alpine habitats (Moore and Friedley 2006).

Overall, based on current information, threats to *Aster alpinus* var. *vierhapperi* are considered relatively low. However, this should be tempered with the high number of unknowns for this species.

Key ecosystem characteristics and ecological conditions for recovery, conservation, and viability:

There is currently one known occurrence of this species on the RGNF, it is therefore critically important to maintain that occurrence. Presently, most threats appear to be at a relatively low and manageable level. Global climate change will likely affect all plant communities to an unknown degree over time. How this species will cope with this potential change is unknown, but, as discussed above, alpine habitats are expected to respond negatively to climate change.

The RGNF should strive to maintain habitat conditions for *Aster alpinus* var. *vierhapperi* by applying suggested management practices as follows:

- 1) Manage habitat - Manage and adjust pressures from any management influences found to be creating unacceptable impacts.
- 2) Manage environmental stressors - Continue assessing the RGNF's contribution to global climate change and adjust actions where permissible within the Forest Service's legal and regulatory authority. Use tools such as the Forest's Climate Change Scorecard to assess impacts and make positive changes where needed. Reductions in the RGNF's contribution to global climate change should benefit *Aster alpinus* var. *vierhapperi*.

Key uncertainties and information needs/gaps:

There are a large number of information gaps and research needs for this species. Re-visiting the known occurrence, estimating current abundance, assessing imminent threats, measuring demographic parameters, studying genetic variability, and determining ecological needs and limitations are of primary importance to further the understanding of *Aster alpinus* var. *vierhapperi*. The following suggestions are ordered from inventory activities (to determine the current status) to more complex biological studies (to help understand the species):

- Re-visiting and detailed mapping of the known occurrence
- Surveying for new occurrences
- Addressing any imminent threats to the known occurrence

- Defining and measuring microhabitat characteristics
- Measuring demographic parameters using long-term monitoring plots
- Analyzing genetics to assess gene flow and variability throughout range
- Conducting studies related to reproductive biology, including breeding system, germination trials, dispersal capabilities, pollinator surveys, mycorrhizal associations, and seedbank analyses.

The following is an outline of a monitoring approach that could be used to inform the development of the RGNF Forest Plan revision's monitoring plan. Additionally, areas of research opportunity (beyond the scope of the Forest Plan revision) are suggested below based on key uncertainties about this species.

- 1) Monitoring: monitoring priority is a judgment determination based on number of occurrences, potential threats, and conservation status. The priority for this species is thought to be moderate. This is primarily due to the status being G5S1 (see Table 1), its high altitude habitat and very limited occurrences on the RGNF. Existing management practices are not known to be causing detrimental impact. Only limited search effort and monitoring have been conducted so individual occurrences may be vulnerable to unforeseen impacts. Thus, monitoring is suggested as follows:
 - a. Search for and document new species occurrences found on the Forest. Ensure that additional occurrences, as well as negative search results, are recorded in the appropriate electronic database. Additional occurrences increase the odds in the confidence of assessing population viability, especially with greater geographic separation. Finding additional occurrences helps inform whether additional monitoring is needed and at what intensity.
 - b. Monitor known element occurrences to document presence or absence. Evaluate each occurrence based on appropriate database protocols. Visually document the same populations every 5-7 years (twice in a planning cycle). Consider enlisting an organization such as CNHP to help develop a rapid monitoring technique that is meaningful for trend analysis but is easy to establish and simple to evaluate.
 - c. Make visual observations to assess if any impacts are occurring to the known occurrence. Assess the type, source, frequency, and magnitude of the impact. Develop a strategy at the appropriate time for mitigating impacts (eliminate, move, delay, or reduce the impact).
- 2) Research:
 - a. Reproductive biology, autecology, and demography - there are many unknowns about this species' life cycle suggesting numerous areas of potential research.
 - b. Genetics - an accurate estimate of this species' genetic vulnerability is unknown.
 - c. Disturbance - there are unknowns about the role and types of disturbance and their possible effects on *Aster alpinus* var. *vierhapperi*.

d. Environmental uncertainty:

- i. Continue and/or expand studies on the effects of air pollution on alpine environments, plant communities and specifically on *Aster alpinus* var. *vierhapperi*.
- ii. Continue and/or expand studies on the effects of global climate change on alpine environments, alpine plant communities; and specifically on *Aster alpinus* var. *vierhapperi*.

Key literature:

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Map of Known Occurrences:

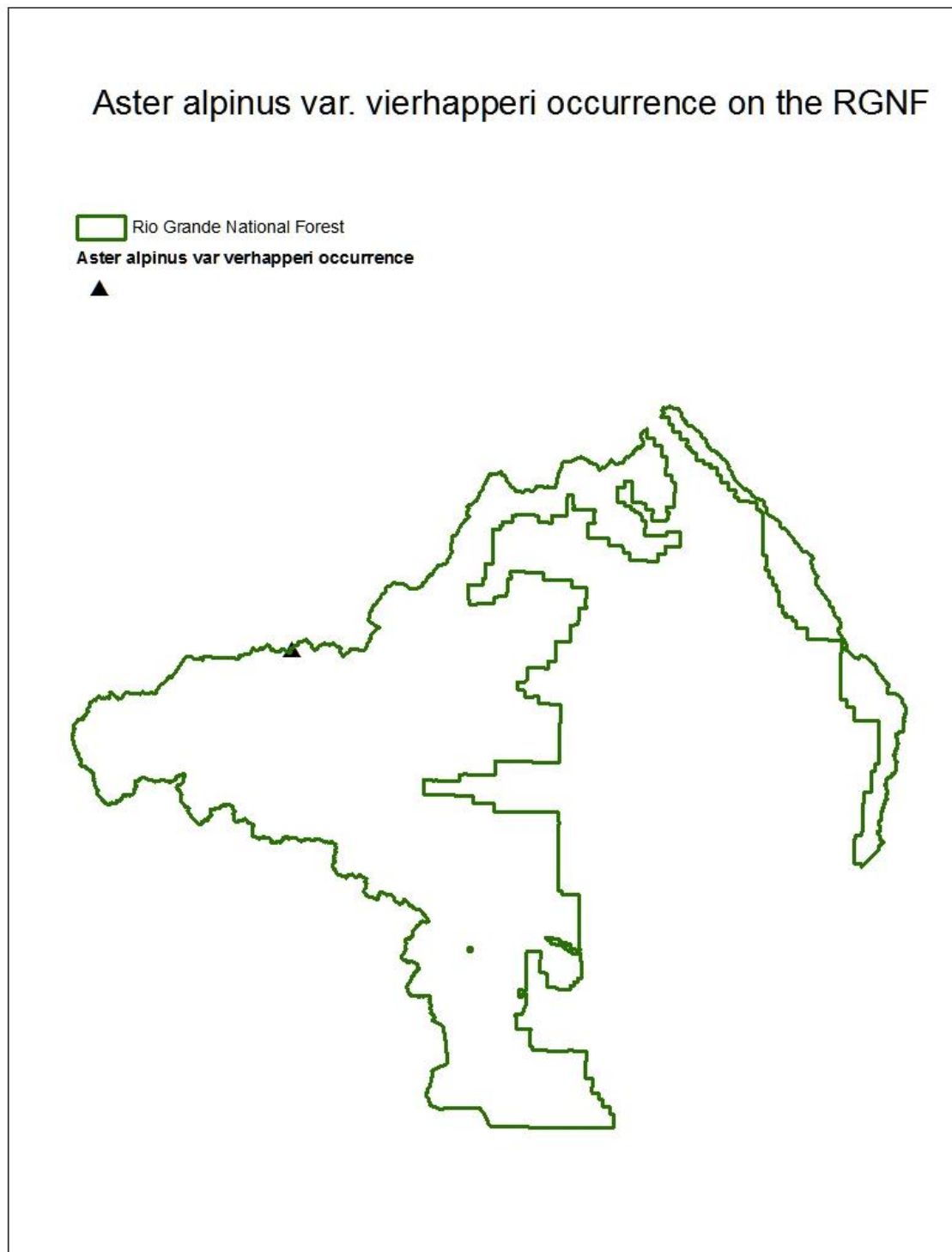


Figure 1 *Aster alpinus* var. *vierhapperi* occurrence on the RGNF.